ELECTROCHEMICAL STRAIN SPECTROSCOPY OF LITHIUM TITANIUM SPINEL WITH DIFFERENT DEGREE OF CHARGE

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Electromechanical coupling between tip of scanning probe microscope and material allows to study electrochemical properties and phase transformations both in thin films and bulk electrodes [1]. This method is based on the probing of Vegard strain induced by AC and DC voltage applied by conductive probe to the grounded sample [2]. Usually people use time spectroscopy representing relaxation of high frequency electrochemical strain signal after 500ms-1s DC pulse and voltage spectroscopy representing hysteresis of strain induced by series of DC voltage pulses with increasing and decreasing heights to probe local coefficients of diffusion and concentrations of charge carriers.

Here we implemented electrochemical strain measurements in lithium titanium spinel (LTO) prepared using chemically pure titanium dioxide TiO_2 (anatase) and chemically pure lithium carbonate Li_2CO_3 by means of solid state synthesis. LTO is one of the most perspective commercial materials, which are good alternatives for the traditional carbon anode.

In spite of relatively small electrochemical expansion of the lattice parameters (less than 0.5% of volume change) we measured electrochemical strain signal and estimated diffusion coefficients and local distribution of lithium concentration across the surface. We believe that registered strain in LTO is due to high values of diffusion coefficient, which is confirmed by electrochemical measurements [1,3]. The data have been obtained for the material with different state of charge and shades further light to the methodical aspects of electrochemical strain microscopy in bulk electrodes materials.

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2. Jesse S. et al., Rev. Sci. Instrum., 77, 073702 (2006)
3. Zhao B., et al., Mater. Sci. Eng., R, 98, 1, (2015)